

Design of ARCSI Learning Model with Scientific Approach for Teaching Mathematics in School

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ABSTRACT

The study was aimed to obtain information regarding the design instructional of ARCSI learning model with the scientific approach for teaching mathematics in school. This learning model developed based on the learning conditions at Junior High School (SMP/MTs) in Bukittinggi City and Agam Districts of West Sumatera requiring a model of learning based on Islamic values, strategy in the motivation of ARCSI, and a scientific approach mandated in the curriculum of 2013. This learning model is designed for forming the character of learners in an Islamic way the learning process of mathematics that pleasant, and train students to think critically and comprehensively through a scientific approach. Synonymous ARCSI Learning Model with scientific approach, namely: (1) Attract the attention of learners by inviting praying/pleading to Allah Ta'ala, (2) Convey the purpose/benefit of learning and its application in daily activity, (3) The deliberations of the group to establish ukhuwah Islamiyah within the group, (4) a class discussion to establish ukhuwah Islamiyah classically, (5) Giving satisfaction to students with learning will make only because of Allah Ta'ala and the tradition of Prophet Muhammad SAW (6) Evaluate processes and the results of solving problems, and (7) Closing the learning by reading Hamdallah and greetings.

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1. INTRODUCTION

The Teaching mathematics with the ARCSI learning model based on a scientific approach can help shape the ability of students to present concrete ideas and knowledge in the abstract, solve abstract problems, and practice rational, critical and creative thinking (Small, 2000; Herdiana, 2017). In the 2013 curriculum emphasizes the importance of the balance of attitude, knowledge and skills competencies (Nurhalim, 2015; Hakim, 2017). The mathematical abilities demanded are formed through continuous learning, which begins with increasing knowledge of mathematical methods, followed by the skill of presenting a problem mathematically and completing it, as well as the formation of honest, critical, creative, thorough, and obedient attitudes (Hakim, 2017; Thahir, 2018).

The ARCSI learning model with a scientific approach can describe the effort that must be made by the teacher and students to achieve the expected competencies (In'am, 2017; Herdiana, 2017; Small, 2000). This learning is in accordance with what is mandated in the 2013 curriculum, namely students must be brave to find other learning resources that are available and widely spread in the surrounding environment. The role of the teacher is very important to increase motivation and adjust the absorption of students with the availability of activities in the syntax of this learning model (Afandi, 2018; Fonna, 2018b). Teachers can enrich it with creations in the form of other activities that are appropriate and relevant to the social and natural environment.

According to (Keller, 1987; Mursalin et al, 2018) a teacher may change the learning environment so that students can motivate themselves. For example, in the learning process, there is a possibility that a teacher will teach well, but students actually learn nothing from it. Students sometimes feel heavy or do not want to learn something that is not felt meaningful to him. Students only memorize teaching material and often forget what they learned after they finished learning a teaching material. Students will choose not to apply what is learned because they are not interested in what has been learned.

One specific motivational strategy for the field of education has been developed by Keller. The four components of the motivation strategy are attention, relevance, confidence, and satisfaction with the acronym ARCS (Keller, 1987; Fonna, 2018a). This strategy emphasizes the design of a form of motivation that can be applied by the designer or instructor in the design of the form of teaching material. According to (Keller, 1984) and (Visser 1990), "studies evaluating this model have an evidence to support the validity of the four basic constructs and their positive effects on student attitude and performance".

The ARCS motivational strategy is a systematic strategy in the form of motivating instruction (Small, 2000). The motivation strategy has been used extensively (Means et al. 1997; Shellnut, Knowlton & Savage 1999; Song & Keller 2001; Hyland 2006). The ARCS strategy has also been applied in certain types of instructional settings such as computer-based instruction (Keller & Suzuki, 2004),

textual material (Keller et al, 1987), instructor-led formal lecture (Visser et al, 1990) and online assessment (Hyland, 2006). The motivation of students towards mathematics learning collected in this study is related to (a) Attention, (b) Relevance, (c) Confidence, (d) Satisfaction.

The ARCSI learning model combined with a scientific approach according to the 2013 curriculum will be an interesting learning model for students, challenging, and provide an atmosphere that is different from other conventional learning models (Amalia et al, 2018). At present most teachers teach in schools using conventional learning models, although in the current curriculum it requires teachers to use creative, innovative learning models. Therefore, the purpose of this study was to design an ARCSI learning model with a scientific approach and practical steps for teachers. It is expected to be an innovative, creative model that makes it easier for students to learn.

ARCSI Learning model with the scientific approach is a new learning model developed through a study entitled "Development of ARCSI Learning Model with Scientific Approach" at the Junior High School in the Bukit Tinggi City and Agam District of West Sumatra. In order for educators can understand and apply this model so

books learning model ARCSI by scientific approach is developed. This model integrating strategy motivation ARCS and Islamic values that required teachers in learning mathematics so can form the character of the student in an Islamic way can increase the involvement, motivation, and result of learning for the student.

This writing introduce to the teachers about the ARCSI learning model with scientific approach, these are: (a) Rational the preparation of book model; the formal, the theoretical, and the fact learning in Junior High School, And also the purpose and usefulness of book model arranged, (b) The characteristic of ARCSI learning model with the scientific approach, (c) The social system, the principle of the reaction, and the support system, also the impact of instructional and accompanist that expected in ARCSI learning model with scientific approach.

2. METHODS

This type of research is the research design. The procedure uses a model development Plomp (2013) as shown in Table 1 below.

Tabel 1. Phase Development ARCSI Learning Model with Scientific Approach

No.	Development Phase	Criteria	Activity	Description of Activities
1.	Preliminary Research	Emphasis on the validity of the content	Needs Analysis and context	Initial investigations need ARCSI learning model with a scientific approach
			Review of Literature	Collect a variety of information, including: the conditions of learners, curriculum and learning tools that are being used. Analyze the theories and concepts associated with learning model development ARCSI with Scientific approach.
			Development of a conceptual framework and theoretical framework	Designing and developing a conceptual framework and theoretical framework for learning model ARCSI with this scientific approach.
2.	Prototyping	Practicality and effectiveness	Designing Prototype	Designing learning model ARCSI with a scientific approach.
			Formative evaluation	To test the validity of (expert validity, focus groups and field test) to the prototype.
			Revision	Revised the prototype is based on the results of formative evaluation.
3.	Assesments	Practicality and effectiveness	Summative evaluation	Assess whether the user in the field can use the product and intends to apply in mathematics, and to test whether the product is effective.

Source: Modified by Plomp (2013).

3. RESULTS AND DISCUSSION

3.1 Rationable

The preparation of ARCSI learning model with scientific approach book based on: (1) laws and government regulations pertaining to education, (2) study theoretical pertaining to ARCSI learning model with the scientific approach, and (3) the fact learning that takes place in Junior High School.

Formal Fundament

Some of the formal foundations underlying the preparation of this model book include:

- 1) Law of the Republic of Indonesia Number 20 of 2003 on National Education System.
- 2) Government Regulation of the Republic of Indonesia Number 19 of 2005 on the National Education Standards of Education.

- 3) Regulation of the Minister of National Education of the Republic of Indonesia number 22 of 2006 on Content Standards for Primary and Secondary Education units.
- 4) Regulation of the Minister of National Education of the Republic of Indonesia number 23 of 2006 on Graduate Competency Standards for Basic and Secondary Education Units.

Regulation of the Minister of National Education of the Republic of Indonesia Number 41 of 2007 on Process Standards for Basic and Secondary Education Units.

Theoretical Foundation

The theoretical foundation in the development of the ARCSI learning model with the scientific approach is as follows.

- 1) Theory of Vygotsky's Social Constructivism.
- 2) David Ausabel's meaningful learning theory.
- 3) Learning Theory Piaget.

- 4) Learning Theory of Jerome Bruner.
- 5) Motivation Theory ARCS Motivation Strategy (attention, relevance, confidence and satisfaction).
- 6) Theory of Islamic Values.
- 7) The Scientific Approach in Mathematics Learning

Learning Facts

The fact of learning in the field in the form of data from the results of the early analysis on the implementation of the teaching process in SMP/MTs. These are; (1) the learning process has not been done well, (2) the learning process conducted by the teacher is still conventional, (3) the absence of serious effort from the teacher to change the pattern of learning with the application of learning models that can motivate and activate learners during the learning process as mandated by the 2013 curriculum. The facts in this field are further explored and processed in the form of a dissertation entitled Development of ARCSI Learning Model with the Scientific Approach (Studies at SMP/MTs in Bukittinggi and Agam districts).

a. Purpose

This model book is structured with the aim of increasing the understanding of teachers/education practitioners about the ARCSI learning model with the Scientific Approach that has been developed.

b. Usefulness

The usefulness of this model book is:

- 1) This model book is prepared in the hope that it can help teachers/education practitioners in order to perfect the learning process.
- 2) This model book is supposed to be an additional reference for teachers in crafting a fun lesson. The model is designed to integrate ARCS motivational strategies, Islamic values, and scientific approaches in line with the demands of the 2013 curriculum.

3.2 Characteristics of ARCSI Learning Model with Scientific Approach

Learning models relevant to mathematical characteristics and mathematics learning objectives are numerous, such as; (1) problem-based learning models, (2) contextual learning, (3) cooperative learning and many other learning models. However, the existing learning model has not been designed to make the learning process fun, and the teacher in the learning process has not applied the values of the character sourced Alqur'an, and hadith, and the learning process of mathematics concept has not followed the scientific approach mandated by the curriculum 2013.

The process of learning mathematics with ARCSI learning model with this scientific approach will form the ability of learners in presenting abstract concrete ideas and knowledge, solving abstract problems related, and practicing rational, critical and creative thinking. As part of the Curriculum 2013 that emphasizes the importance of balance of attitude, knowledge and skill competencies. The required mathematical skills are shaped through continuous learning, which begins by increasing the knowledge of mathematical methods, followed by the skill of presenting a problem mathematically and solving it, and leading to the formation of honest, critical, creative, meticulous, and principled attitude.

ARCSI learning model with this scientific approach describes the minimum effort that teachers and learners should do to achieve the expected competencies. Learning with a scientific approach in accordance with the mandated curriculum 2013, learners are

encouraged to seek from other sources of learning available and stretched around it. The role of teachers is very important to improve motivation and adjust the absorption of learners with the availability of activities on the syntax of this learning model. Teachers can enrich it with creation in the form of other activities that are relevant and relevant to the social and natural environment.

Based on the theoretical basis, the design of the ARCSI learning model with the scientific approach applied follows the 5 main components of the learning model are: syntax, social system, reaction principle, support system, and instructional and accompanist effects (Joyce and Weil 1992: 14-16) as described below.

1. Syntax

- a. *Draw the attention of learners by inviting praying/pleading to Allah Ta'ala. so that science can be claimed to be closer to God Almighty*

The activities performed in this syntax are:

- 1) Conditioning the class by asking students to read the Qur'an or pray (Islami).
- 2) The teacher reminds the students that we are obliged to always expect the pleasure of Allah Ta'ala in learning, because only Allah Ta'ala. which will give understanding to his servant to the knowledge learned (Islami).
- 3) The teacher displays the student's environment phenomenon related to the learning material, and asks some questions that aims to explore students' knowledge (Islami, Attention).

(Platform Theory: Ausabel Theory, Keller Motivation Theory (Attention), J. Bruner Theory, Alqur'an and Hadith).

- b. *Convey the purpose/benefits of learning and its application in everyday life*

Activities performed on this syntax are:

- 1) The teacher displays the learning objectives to be achieved, and explains the learning process that the learners will do according to the ARCSI Learning Model with the Scientific Approach (Islami, Relevance).
- 2) Teachers outline about learning materials and problem-solving steps with varied methods and attractive appearance (Islamic, Relevance).
- 3) Teachers distribute teaching materials, students group work sheets (LKKPD), and object models to be observed (Attention, Confidence).

(Theory of Theory: Ausabel Theory, Keller Motivation Theory (Attention, Confidence, Relevance), The Scientific Approach, J. Bruner Theory, Alqur'an and Hadith).

- c. *Group deliberation to establish ukhuwah Islamiyah in the group*

Activities performed on this syntax are:

- 1) The teacher assigns / asks the learners to observe, study, and formulate questions about the phenomena observed in LKKPD (Islami, Attention, PS 1, and PS 2).
- 2) The teacher assigns students to group meetings to gather information from various learning sources, as well as from the knowledge that the students have mastered to answer the questions that have been formulated, and the teacher acts as a mentor and supervisor in deliberation. Teachers always

remind and motivate learners to foster cooperation in groups (Islami, Attention, Satisfaction, PS3, PS4).

- 3) The teacher assigns students who already understand the learning materials, to help their uninformed friends. The help given to someone will be rewarded from Allah Ta'ala (Islami, Satisfaction).
- 4) Teachers are always going around in each group to motivate, monitor learners' work, and provide help when needed with great sincerity and affection. The teacher should always remember that the learners are new learners, do not know, and expect the attention and guidance from the teacher.
- 5) The assistance and attention given by teachers with full sincerity will not be in vain, for Allah Almighty. will always take into account all the actions of his servant (Islami, Attention, Relevance).
- 6) Teachers provide motivation to always cooperate and help each other, patient and eager in work (Islami).
- 7) Teachers provide guidance to learners when needed (Islami, Attention).

(Basis Theory: Piaget Theory, J. Bruner Theory, Keller Motivation Theory (Attention, Relevance, Satisfaction), Alqur'an and Hadith).

d. Deliberation Class to establish ukhuwah Islamiyah in classical
Activities performed on this syntax are:

- 1) The teacher provides facilities, and assigns classical deliberate participants, to communicate the results of the group meetings by asking each group's representatives to present their work (Islami, PS5, Attention, Relevance)
- 2) The teacher assigns to different groups to respond to the answer of the presenter group, and the teacher as a mediator in the deliberation (Islami, Relevance, Confidence).

(Basis Theory: Piaget Theory, J. Bruner Theory, Keller Motivation Theory (Attention, Relevance, Satisfaction), Alqur'an and Hadith).

e. Giving satisfaction to the learners by sincerely intending to learn because of Allah Ta'ala. and the sunnah of Muhammad Saw.

Activities performed on this syntax are:

- 1) The teacher gives confirmation (strengthen) about learning materials to omit the students' hesitant, and to convince the students about the truth of the concept concluded from the output of discussion. (Islamic, Satisfaction).
- 2) Teacher asks the students to formulate the conclusion from the learning materials that has been discussed and emphasized.
- 3) Teacher guides the students to conclude learning materials by asking the students to reveal important ideas that have been learned from the learning materials (Islamic).
- 4) Teacher gives reward to the group of students who work well (Islamic, Satisfaction).

(Base Theories: Piaget Theories, J. Bruner Theories, Keller Motivation Theories (Satisfaction), Alqur'an and Hadist).

f. Evaluating process and the result of resolving problems

The activities in this syntax are:

- 1) Teacher evaluates individually by using LKIPD (*Confidence, Satisfaction*).
- 2) Teacher reminds the students to be honest and sportive because honesty and being sportive will make us being appreciated (Islamic).

g. End the learning process by inviting the student's saying hamdallah and peace

The activities in this syntax are:

- 1) Teacher asks the students to do homework's at home based on the learning materials of the students' book (Islamic, *Confidence*).
- 2) Teacher needs to remind/motivate the students to learn sincerely because Allah Ta'ala will raise the level of people who have faith and knowledge on some levels (Islamic).
- 3) Teacher asks the students to be grateful to Allah Ta'ala. For all learning activities which has been done, hope Allah will give understanding about what have been learned (Islamic).
- 4) Teacher ends the learning process by inviting the students to say Alhamdulillah (Islamic).

2. Social System

The organizing of students during the learning materials applies the cooperative learning style. In the interaction of socio-cultural between the students and friends, teacher always implements the Islamic values such as the value of Ukhuwah Islamiyah among the students by applying various ways: (1) Appreciating each other, (2) taking advantages each other, (3) helping each other, (4) being humble, (5) not underestimating other friends (6) not feeling as the most right one, (7) cooperating to solve problems, (8) asking and discussing between the clever students and the less clever students, (9) the freedom of conveying opinions, conversing, and debating (10) helping and cooperating to have a way for solving problems.

In addition, the other social system which is expected to appear is cooperating and helping each other to understand the materials concepts by the students, there is a responsibility in group and individually. (Base Theories: Joyce & Weil (2011), Kardi (1997), Dirjen PMD PSMA (2013), Alqur'an and Hadist)

3. Reaction Principles

The reaction principles which are designed and expected to appear in learning Model ARCSI by using scientific approach are; (1) Teaches gives supports by using the appropriate words, (2) teacher gives guidance if there is a student who finds difficulties in learning, (3) teacher gives learning facility for mastery of mathematic concepts, (4) teacher gives opportunity to the students by reconstructing and conveying the result of thinking, (5) teacher gives explanations/helps by using the wise words, and (6) teacher gives evaluation.

To bring the behaviors into reality, teacher has to give opportunities for the students to convey their results of thinking deliberately and open minded, observing the students' understanding about the mathematics' object that are obtained from the processes and problem solving, showing the weaknesses on students' understanding and stimulate them to find the way to solve problems.

If a student asks, before the teacher gives explanation/help, teacher gives other students' opportunity to convey their reaction and conclude the results. If the whole students face difficulties, it is a time for teacher to give explanations or help/ gives clue until the students can take over the problem solving on the next step. When the students are working on finishing the tasks, the teacher controls the discussion process and gives motivation to keep the students doing their tasks. (Base Theories: Joyce & Weil (2011), Kardi (1997), Dirjen PMD PSMA (2013), Alqur'an and Hadist).

4. Supporting System

The supporting system learning model ARCSI using scientific approach which is developed to be model book, teachers' work orientation book and students' work orientation book, learning materials and learning media based on learning model ARCSI using scientific approach.

The teachers' work orientation book is a guidance book in managing the learning process that has been designed in the form of Lesson Plan. While the students work orientation book is the guidance book about the steps on learning process that will be done by the students and consists of the group work sheets of the students and the individual work sheets of the students and learning materials also the learning media that has been compatible with the ARCSI learning media component using scientific approach. (Base Theories: Joyce & Weil (2011), Kardi (1997), Dirjen PMD PSMA (2013), Alqur'an and Hadist).

5. The expected instructional and accompanist impacts

The social and accompanist impacts that are designed in learning model ARSCI using scientific approach are:

- Instructional impacts: (a) an ability to reconstruct concept and principle, (b) the ability to analyze logically and critically, (c) the ability to collaborate between the students.
- Accompanist impacts: (a) to find again various concepts, (b) the essence of knowledge, (c) the occupation of sciences process, (d) the autonomy and thinking deliberately, (e) tolerance values, (f) motivation and learning output of math of students are high, (g) knowing and teachers and students (h) the willingness to do, (i) teacher's patience and students' patience. (Base Theories: Joyce & Weil (2011), Kardi (1997), Dirjen PMD PSMA (2013), Alqur'an dan Hadist).

4. CONCLUSION

Based on the discussion above, it can be concluded that the design of ARCIS learning with the Scientific approach can be used as learning that makes it easy for students to understand mathematics, make students challenging, turn on the atmosphere of cooperative learning. In addition, this learning model is designed to shape the character of students in an Islamic way with a fun learning process of mathematics, and train students to think critically and comprehensively through a scientific approach.

The ARCSI learning model is identical to the scientific approach, namely: (1) attracting the attention of students by inviting prayers/requests to Allah Ta'ala, (2) conveying the purpose/benefits of learning and its application in daily activities, (3) group discussion to establishing Ukhuwah Islamiyah in groups, (4) class discussions to establish Ukhuwah Islamiyah classically, (5) giving satisfaction to students by learning will make only because Allah Ta'ala and the

traditions of the prophet Muhammad see (6) evaluating the process and results of problem-solving, and (7) close learning by reading Hamdalah and greetings.

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